# SERVICING THE WAFADRIVE

Most Wafadrives returned for repair simply require adjustment to bring them within specification and get them working correctly. Some units require replacement of drive units due to failure and some require the addition of an inverter to prevent "crashing" and interference problems - mainly with later issues of Spectrums. The general repair procedure is as follows:

1. Disassemble the unit and visually inspect for signs of damage or abuse. Note the condition of the ribbon cable and connector assembly in particular.

2. If the unit is "unmodified" (ie. has not had C36 removed and an inverter fitted), then this should be carried out:

   i). Remove C36 by bending the body of the component over and cutting the leads. Take particular care to avoid damaging the adjacent fine PCB tracks. It is recommended that C37, D20 and D21 are also removed.

   ii). Attach the inverter to the rear of drive unit A by means of a double-sided sticky pad.

   iii). Connect the violet trailing lead to 0V. A convenient point is the track running between the Centronics and RS-232 connectors at the very rear of the board.

   iv). Connect the red trailing lead to -12V. The best point is to R33 - at the end nearest R32 on the board.

   v). Connect the white trailing lead to +5V. The regulator terminal nearest the edge of the board (marked "OUT") is the best place.

   vi). A capacitor may be fitted to the connector assembly PCB. This should be removed by cutting it out.

3. Connect the Wafadrive to a Spectrum and power the system up. If the normal Sinclair copyright message is not displayed after a second or two, disconnect the power immediately. Check the Wafadrive for short circuits on the address/data busses etc. Solder bridges are unlikely as the units are tested several times in the factory - they are not unknown however. If the screen appears near-normal but with heavy horizontal bar distortion indicative of 50Hz interference, suspect a power supply overload. Check the power supply voltages at the regulator. A component which has failed in this manner will usually be hot to the touch - and may even smoke. Prime suspect is the inverter, temporarily disconnect the red and white wires and see if this restores normality.

4. Initialise the Wafadrive by entering **NEW ***. If the Wafadrive does not initialise, but the computer appears to function normally otherwise, suspect an open circuit line (check that the PCB tracks around C36/37 etc. are undamaged). Check also the Wafadrive's power supply rails and the EPROM socket. If using an unfamiliar Spectrum, check that the processor is giving out the M1 signal.

5. The drive motors can be started by keying **LET 1=IN 1546** (A) or **LET 1=IN 5130** (B), and can both be stopped with **LET 1=IN 10**. Start each drive in turn and clean the heads and motor spindles with a cotton bud. The motor shafts can be checked also for eccentricity by feeling for excessive vibration when cleaning them.

6. Load the speed test program into drive A. If the R/W speed is more than 4% in error, correct it by adjusting the control screw under the motor. Easiest access is gained by removing the drive but it can be adjusted with a specially fabricated "bent screwdriver". If fast forward speeds are low - less than say 30% - the unit can be modified to increase them. 33R resistors are added across R52 and R53 and 1N4148 diodes across R42 and R43 (cathode at the Q2/Q3 end). The process can be repeated with drive B, but it is not necessary to reload the program. Simply enter CAT *"b:", whereupon the report **Wafer not inserted** will be given. Insert the speed test wafer in drive B then enter **RUN**.

7. The heads can now be aligned. Insert a 30KHz alignment wafer in drive A and start the motor as described above. Monitor the signal across R18 with a dual beam CRO set to display the differential signal. If a CRO is not available capable of this, a differential amplifier will have to be made and used instead. The hex alignment screw should be adjusted to yield optimum signal amplitude (about 300mV p-p). If the adjustment is "sloppy", the rubber "O" ring under the head retaining flange has probably been over-tightened and distorted. Remove and replace with a new one. When satisfied, lock the screw head with a modest application of thread fixing glue. The procedure can then be repeated for drive B. Inadequate signal amplitude is most often due to bad connection of head cables, failure of U26, U27, L1 or L2.

8. Now insert a wafer which has some data recorded on it in drive A and start the motor. Monitor pin 3 of U3 with a CRO and adjust VR2 to achieve a pulse length of 41.5uS (plus or minus 1uS). In some cases R20 needs to be padded to enable this to be achieved.

9. Remove all wafers and disconnect the power. Inject a 18KHz sine wave signal at 4mV p-p into pins 1 and 2 of U27. Power the system up, switch on drive A motor and monitor the signal at pin 10 of U27 on the CRO. With the timebase at 5uS/div, a pulse will

# TESTING THE WAFADRIVE

Most of the Wafadrive's operations can be checked using a simple test procedure in the form of a program on wafer. The ROTRONICS test tape carries out a sequence of checks to simulate the useage a Wafadrive normally experiences in the customer's hands and to highlight some of the known potential problem areas - particularly with respect to mechanical and electrical alignment.

The description of the test procedure that follows refers to the ROTRONICS test program version 2 and the test procedure which will be found accompanying this document.

## Preliminary procedures

Before testing commences a "reference" drive unit should be established using traceable standards. Firstly the shafts are honed in the manner described by ENTREPO, checked for run-out and the heads cleaned. The motor speed is then set to precisely 2425 rpm using the BSR adaptor to extract the motor commutator pulses. This equipment should be left connected during the subsequent operations to prevent errors due to speed drift.

Each drive should then have the head aligned in the correct manner - using an ENTREPO serial-numbered alignment wafer and adjusting signal amplitude to a maximum on the CRO.

The phase balance pot (VR1) can then be adjusted for correct relationship between positive and negative peaks by injecting a sine wave signal from the BSR test generator.

Finally the monostable time period is set to 41.5 uSecs (VR2).

To make a copy of the test wafer, insert a blank (16K) wafer in drive A. Insert the test wafer master in drive B then enter:

```
MERGE *"B:": GO TO 150
```

When the program has loaded it will commence a speed check on drive A and display the time taken to wind the tape from index to index at normal (r/w) speed. Take the average of several passes (use BREAK followed by GO TO 150) all the time ensuring that the indicated speed on the test equipment is still exact and that the test gives consistent results. If not, use another wafer or change the drive.

When this has been achieved, edit line 5020 of the program and set nrt to the correct value for that tape. Then enter:

```
GO TO 9e3
```

Whereupon the test program will be duplicated on the wafer in drive A. When finished, label the wafer and remove the write-protect tab. Repeat if more copies are required.

be seen at the left hand side of the screen together with another roughly central. The central one will usually appear vague - adjust VR1 until it steadies and appears as a single pulse. Without a generator, this test can be done "in the field" using an accurately duplicated wafer instead of the external signal source. Upon completion, power down again and disconnect the signal source.

10. Before re-assembly the Rotronics test program should be executed all the way through. This culminates in the printing of a test record which should be error free.

## The test procedure

The test program has been written in BASIC to allow changes to be easily made. More importantly, the program can be stopped at any time using the BREAK key and a test repeated by typing:

```
GO TO n
```

Where in general n is equal to the test number multiplied by 10 - eg. GO TO 90 to start the program again at test 9.

bad sector reports cannot be tolerated - they are indicative of misalignment. "Soft errors" can occur for other reasons but they are rare. Repeat the test if in doubt. Only units that can perform all tests without errors occurring are acceptable.

1. The first step is to examine the Wafadrive and the associated manuals and wafers. Check that the package is complete, that the unit has been assembled correctly and that there are no visible signs of damage.

On returned units check head condition, hone the shafts and check for run-out.

2. Next connect the Wafadrive to a 48K Spectrum and plug a ZX Printer (or similar) into the rear of the Wafadrive. Switch on, and assuming that the system powers up correctly, enter:

```
NEW *
```

Whereupon the Wafadrive sign-on message should be displayed.

3. Insert the "Spectral Writer" wafer in drive A and enter LOAD *. Check that the program loads correctly - without any bad sector reports. Trouble with loading may be indicative of a misaligned drive or a badly duplicated wafer. Remember that the first thing a customer does with the Wafadrive is to load this program and a failure here does not help the reputation of the product. If there is a problem, try loading the program into the reference drive to determine the cause.

Remove the program wafer, wrap in a polythene bag and replace in the packaging. Reset the system (use a switch or interrupt the power).

4. Insert the test wafer in drive A and enter LOAD * to load the test program which will auto-run. A title message will be displayed when loading is complete and the tests can be started. Since the test program has been duplicated on a standard drive there should be "beeps" indicative of loading errors.

5/6/7/8. These tests check the "wafer present" and "write protect" switches in the drives. Swap the test wafer (which is write-protected) and the blank 64K wafer (which is not) between the drives and ensure that the indicated status is correct.

9. Ensure that the test wafer is back in drive A and that the blank 64K wafer is in drive B (since this is part of the package it must be tested also) before proceeding to this test. Repeat if any faulty sectors are indicated during formatting. If consistent faults are given, try with another wafer in order to isolate whether the problem is due to the wafer or the drive.

10. This test saves then verifies a file on the 64K wafer (actually a copy of the test program) to check save/load on drive B. Again, no bad sectors are permissible.

11. Swap the wafers over such that the test wafer is now in B. The program then checks that the file saved to B can be read back on A and that drive B also loads in the "display" portion of the test program on the reference wafer.

12. At this point a file is saved/verified on the 64K wafer in drive A to check its basic function.

13. The wafers are now swapped again (test wafer in A) and the file saved to A is verified on B to check interchangeability between the drives. It is interesting to note that drive B's directory has to be "sabotaged" (POKE 23778,0 - line 130) to prevent it verifying the sectors it wrote to during test 10.

14. This part of the test checks the printer interfaces. The Wafadrive should be connected to a Centronics compatible printer and an RS-232 terminal or printer. The test messages should appear on these devices and the ZX Printer also.

15. The next phase is the speed checks. First the test wafer is wound one complete pass (index to index) and the time taken to achieve this is displayed - along with the time normally taken on an accurate drive and the error as a percentage of the two. If the error exceeds 5% a warning notice will flash. A machine code subroutine is used to measure the period as BASIC is not accurate enough.

16. The program will continue by checking the time taken to wind the tape in fast forward mode. This is expressed as a percentage of the r/w speed and the figure is nominally +40%. Anything below +25% should be regarded as inadequate although the program will display a warning message if below +40%. Experienced operators may already have a "feel" for the performance of the unit in this respect at this stage since faulty drives are noticeably slower in operation.

17. When the tests on drive A have been completed, insert the test wafer in drive B and continue with the speed tests.

18. The ff mode time period for drive B is measured and displayed.

Finally, those units that pass all the tests should be cleaned, wrapped and repacked. Put the 64K wafer in a polythene bag and pack in the end cheek.

# WAFADRIVE TEST PROCEDURE

1: Unpack, visually inspect unit & check contents.
FAIL if a). damaged or incorrectly assembled
b). manual missing
c). 64K wafer missing

2: Connect to computer, power up & initialise.
FAIL if a). damages computer
b). crashes computer
c). unable to initialise

3: Load 'Spectral Writer' program to drive A.
FAIL if a). wafer mechanically faulty
b). fails to load
c). loads but with "bad sector" report(s)

4: Load test program to drive A & run.
FAIL if a). program fails to load
b). loads but with "bad sector" report(s)

5: Check 'wafer present' detect on drive A.
FAIL if a). fails to detect presence of wafer
b). fails to detect absence of wafer

6: Check 'write protect' detect on drive A.
FAIL if a). fails to detect write protect status
b). fails to detect non write-protected status

7: Check 'wafer present' on drive B.
FAIL criteria as for (5) above

8: Check 'write protect' detect on drive B.
FAIL criteria as for (6) above

9: Format 64K wafer on drive B.
FAIL if a). wafer mechanically faulty
b). multiple bad sectors (more than 3)

10:Save/verify test on drive B.
FAIL if a). directory cannot be loaded
b). program cannot be verified
c). verifies but with "bad sector" report(s)

11:Verify file saved to B on A & load "standard" file.
FAIL criteria as for (10) above

12:Save/verify test on drive A.
FAIL criteria as for (10) above

13:Verify file saved to A on B.
FAIL criteria as for (10) above

14: Check printer interfaces.
FAIL if a). ZX Printer fails to operate
b). RS-232 port non functional
c). Centronics port non functional

15: Check drive A read/write speed. Note result as a percentage of normal and:
FAIL if outside 5% limit

16: Check drive A fast-forward (search [illegible]) speed. Note result as a percentage of r/w speed and:
FAIL if less than 25% above r/w speed

17: Check drive B read/write speed.
FAIL criteria as for (15) above

18: Check drive B fast-forward speed.
FAIL criteria as for (16) above